

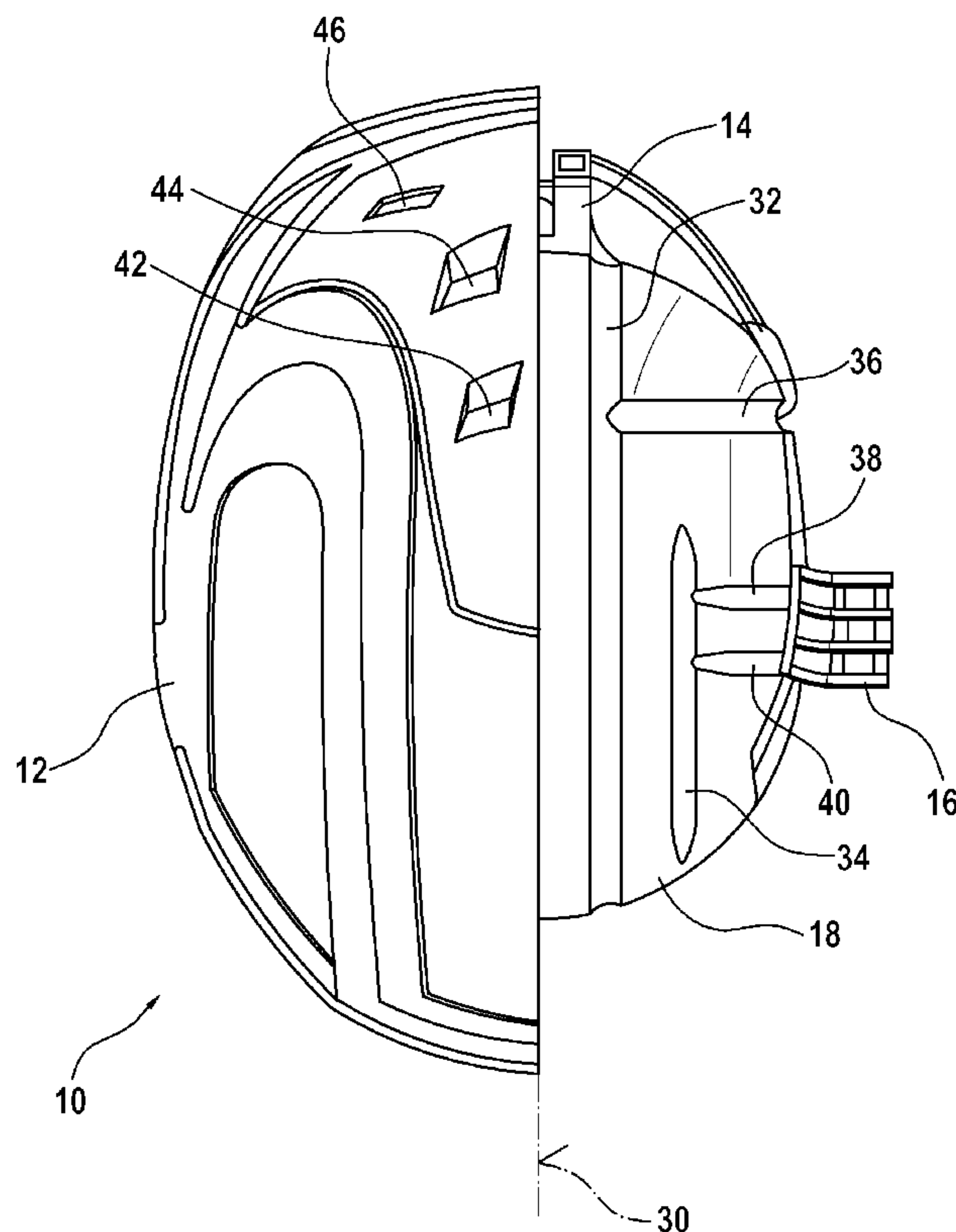


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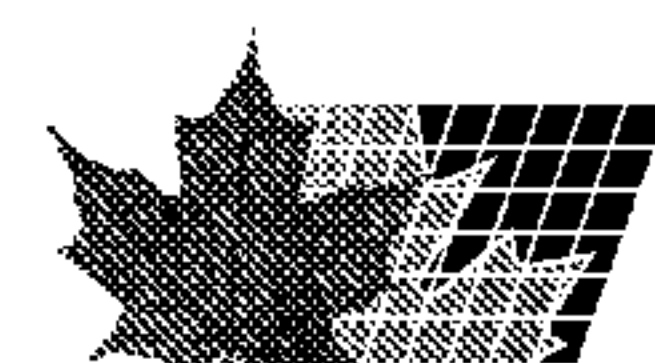
(54) **Titre : CASQUE DE PROTECTION**
(54) **Title: PROTECTIVE HELMET**

Fig. 1



(57) **Abrégé/Abstract:**

The invention relates to a protective helmet comprising a helmet shell (12), a support cage (14) and a securing device for securing the support cage (14) to the helmet shell (12). According to the invention, an impact absorption device (18) is arranged between the support cage (14) and the helmet shell (12).



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Abstract

10 The invention relates to a protective helmet comprising a helmet shell (12), a support cage (14) and a securing device for securing the support cage (14) to the helmet shell (12). According to the invention, an impact absorption device (18) is arranged between the support cage (14) and the helmet shell (12).

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5 Protective Helmet

10 The invention relates to a protective helmet comprising a helmet shell, a support cage and a securing device for securing the support cage on the helmet shell.

Such a protective helmet is, for example, known from the DE 10 2010 097 012 A1. It is particularly intended to protect forest workers, however, it is also usefully deploy-
15 able for applications in industry, on construction sites, and for sports, particularly climbing. The disclosure of the cited publication is, to the full extent, also the disclosure of the present document.

The requirements on a high-quality protective helmet are diverse. Apart from design
20 and wearing comfort, of course the safety provided by the helmet has priority in the requirements specification. The protective helmet is to protect the wearer from impacts of all kinds, for example from falling items or branches from falling trees. In the process the helmet has to accomplish various things. First of all the helmet shell has to be extremely robust to prevent breakage or puncture by rather small items
25 such as stones. On the other hand, the helmet shell also has to have a certain plasticity to absorb the kinetic energy of heavy items impinging on the helmet on this basis. The absorption of the kinetic energy is less about protecting the head covered by the helmet but rather about rendering an injury of the wearer's cervical spine less probable.

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The invention is based on the object to further develop a protective helmet so that, together with a high stability of the helmet shell and the protection against head injuries ensured thereby, an enhanced protection of the wearer against impacts with high kinetic energy and thus an enhanced protection of the cervical spine are
5 provided.

This object is solved by the features of the independent claim.

Advantageous embodiments of the invention are described in the dependent claims.
10

The invention is based on the generic protective helmet in that an impact absorption device is disposed between the support cage and the helmet shell. As a result of the impact absorption device being disposed below the helmet shell a part of the function to be intrinsically fulfilled by the helmet shell, namely to provide for attenuation
15 in case of heavy impacts, is assumed by the impact absorption device disposed below the helmet shell. The helmet shell can, insofar, be substantially optimised without particular consideration of impact absorption, it only has to be sufficiently deformable to be capable of transferring kinetic energy to the impact absorption device disposed below the helmet shell. The former will then take over the major
20 part of the absorption of kinetic energy.

Usefully it is contemplated that the impact absorption device is, at least partly, positively arranged on the helmet shell and/or the support cage. The positive abutment of the impact absorption device on the helmet shell and the support cage
25 ensures that the kinetic energy transmitted to the helmet shell in case of an impact will immediately act on the impact absorption device, and that not a substantial part of the kinetic energy is transferred from the helmet shell to the support cage and thus the head of the wearer first.

30 Comparable advantages are provided by the impact absorption device being, at least partly, non-positively arranged on the helmet shell and/or the support cage.

It is particularly advantageous that the impact absorption device exhibits a substantially plastic deformation behaviour in case of an impact on the helmet shell. If the blows to the helmet are so heavy that actually a deformation of the impact absorption device occurs it is advisable to replace the helmet. Since the impact absorption device is plastically deformed it can be seen that the helmet suffered a heavy impact. Owing to the plastic deformation behaviour it is therefore avoided that a potentially damaged helmet is accidentally used again.

10 The protective helmet according to the invention is, in a particularly advantageous manner, further developed in that the impact absorption device comprises a plurality of cavities which are separated from each other by walls. Owing to the plurality of cavities the impact absorption device is altogether light-weight so that the wearing comfort of the helmet is not affected. Furthermore the cavities provide for the space
15 required for enabling a substantial deformation of the impact absorption device which may, eventually, lead to a substantial absorption of kinetic energy.

It is particularly advantageous that the cavities are, at least partly, formed as tubes. Particularly if the ends of these tubes are, on the one hand, facing the head of the
20 wearer, and, on the other hand, facing away from the head of the wearer, a useful ventilation effect may be favoured thereby. In addition, it can be seen if a helmet was already exposed to a heavy impact without taking it apart by only looking at the impact absorption device through the support cage. Namely, in case of a deformation of the impact absorption device, substantial optical differences will become
25 visible in the area of a deformation due to the translucence of the tubes.

Here, it may be contemplated that the tubes are, at least partly, constituted of one or more extruded copolymers. Such copolymers may be formed with extremely thin walls while still providing for sufficient stability. In this way the requirements of a low
30 weight and a high stability as well as the good absorption properties can be combined.

It is further advantageous that the tubes, at least partly, comprise an inner wall and an outer wall which contact each other, wherein the inner wall is thicker than the outer wall. In case of this design of the tubes, the outer wall can be optimised for the purpose of being connected to the outer walls of adjacent tubes. The inner wall
5 assumes the chief work in absorbing the kinetic energy.

In this connection it is particularly useful that the tubes, at least partly, have an inner wall and an outer wall which contact each other with the outer walls of adjacent
10 tubes being connectable to each other by action of heat.

Usefully it is contemplated that the impact absorption device is made of Koroyd. Koroyd is a material made of extruded tubes consisting of copolymers. The tubes are arranged in parallel and are thermally welded together so that each tube has six
15 neighbours surrounding it. In this way a honeycomb-like structure emerges. The tube array may be readily thermally deformed, laminated, cut, or processed in another way to assume the required form as an impact absorption device between the support cage and the helmet shell. Koroyd is a trademark of the Koroyd SARL.

20 The invention is, in a particularly advantageous manner, further developed in that the helmet shell comprises an additional securing device by which at least one other component apart from the support cage can be secured on the helmet shell, the additional securing device being, in addition, provided as a positioning aid for the impact absorption device. The additional securing device may, for example, be two
25 lugs in which a chin strap for the protective helmet can be mounted. These lugs can be optimally positioned for the exemplary mounting of the chin strap while, at the same time, determining the position of the impact absorption device during the assembly of the helmet. In this way, no errors occur during the assembly of the helmet, which in turn increases overall safety.

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It is further advantageous that the securing device for securing the support cage on the helmet shell is designed so that the support cage assumes an end position with respect to the securing device in the used state of the protective helmet, and that the support cage applies a force to the impact absorption device in the end position which prevents a shift of the impact absorption device between the helmet shell and the support cage. The impact absorption device is ideally held in its position by the force between support cage, impact absorption device, and helmet shell, as well as by the additional securing device.

It is also particularly advantageous that the impact absorption device has grooves forming ventilation channels together with the helmet shell on its side facing the helmet shell. Thermal balance under a protective helmet is an important issue. In particular, overheating in the head area of the wearer causes considerable problems. There are findings that accidents were caused by overheating which thus would not have happened without a protective helmet. In consequence, wearing a protective helmet becomes an absurdity in specific situations. This problem is solved by the ventilation channels in the impact absorption device. Conventional helmets are often lined with foam material to thereby absorb impacts. These foam materials are excellent heat insulators so that in certain situations overheating is to be expected. The impact absorption device with its tubes leading from the head area of the wearer to the direction of the helmet shell enable ventilation in the direction of the helmet shell, wherein discharged warm air and particularly water vapour can then be conveyed on through ventilation channels to the outside of the impact absorption device. In this way the climate inside the helmet is always balanced, and no dangerous situations arise which might be caused by overheating.

A further advantage is that the ventilation channels communicate with openings of the helmet shell. In this way air and water vapour led in the ventilation channels escape to the outside through the openings in the helmet shell without hindrance.

The invention will now be explained by way of example with the aid of preferred embodiments with reference to the accompanying drawings in which:

- 5 Figure 1 shows a plan view of a protective helmet according to the invention with a partly cut helmet shell;
- Figure 2 shows a plan view according to Figure 1 including an enlarged detail;
- 10 Figure 3 shows a front view of a helmet according to the invention with a partly cut helmet shell placed on the head of a wearer;
- Figure 4 shows a side view of a protective helmet according to the invention with a partly cut helmet shell placed on the head of a wearer;
- 15 Figure 5 shows a side view of a protective helmet according to the invention with a partly cut helmet shell and interior fittings placed on the head of a wearer;
- 20 Figure 6 shows a side view of a protective helmet cut in the longitudinal direction; and
- Figure 7 shows a detail from Figure 6.

25 In the following description of the drawings identical numerals designate identical or comparable components.

Figure 1 shows a plan view of a protective helmet 10 according to the invention with a partly cut helmet shell 12. The protective helmet 10 comprises a helmet shell 12 as well as a support cage 14. The helmet shell 12 is at least substantially symmetric
30 with respect to a sectional plane 30. In the present illustration the right part of the symmetric helmet shell 12 is omitted so that a view of the interior fittings of the

helmet is exposed. When the protective helmet 10 is used, the support cage 14 is positioned on the head of the wearer, an intermediate layer, particularly a foam material layer, being capable of enhancing the wearing comfort. The support cage 14 is connected to the helmet shell 12 via securing devices 16. In the present
5 illustration the connection between the securing devices 16 and the helmet shell 12 is not directly discernible since the side of the helmet shell 12 on which a securing device 16 is visible is cut itself. However, the interior fittings of the helmet 10 including, in particular, the support cage 14 and the impact absorption device 18 are also, at least substantially, symmetric with respect to the sectional plane 30 so that it is
10 clear, thereby, that the support cage 14 is connected to the helmet shell 12 on both sides of the protective helmet 10. The impact absorption device 18 has grooves 32, 34, 36, 38, 40 on its surface. They serve as ventilation grooves, and they form ventilation channels together with the helmet shell 12 due to the fact that the impact absorption device 18 abuts to the inside of the helmet shell 12. The relevance of
15 these ventilation channels will become obvious in connection with Figure 2.

Figure 2 shows a plan view according to Figure 1 including an enlarged detail 48. The entire impact absorption device 18 has the structure shown in the detail 48. Namely, the impact absorption device 18 has a plurality of cavities 20 separated
20 from each other by walls. In the described embodiment the cavities 20 are formed as tubes 24 fixedly connected to each other. The tubes 24 connect the area of the impact absorption device 18 on the side of the head with the area of the impact absorption device 18 on the side of the helmet shell. Insofar they permit air and particularly water vapour to flow from the inside to the outside through the tubes 24.
25 In this place the ventilation channels formed by the grooves 32, 34, 36, 38, 40 and the helmet shell 12 come into play. The major part of the gasses escaping to the outside through the tubes 24 is gathered by the ventilation channels and transported to the edge of the impact absorption device 18 or the openings 42, 44, 36 of the helmet shell 12 where the gasses can then escape into the atmosphere. The edge
30 of the impact absorption device 18 is provided with a textile ribbon, mainly for optical reasons. A very coarse textile material is provided so that the gasses can escape

without hindrances at the edge. In addition to cooling the head in consequence of the discharge of air and water vapour the impact absorption device also offers the possibility to let heat radiation pass, and that in a substantially greater extent than, for example, a device made of rigid foam.

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Figure 3 shows a front view of a helmet according to the invention with a partly cut helmet shell placed on the head of a wearer. Here, the edge 54 of the impact absorption device 18 abutting to the support cage 14 is visible which is surrounded by a coarse-meshed textile ribbon (not shown). It can also be seen that the groove 32 runs up to the edge 54 to discharge the transported warm gasses there. The groove 34 ends in front of the edge 54 since it communicates with grooves laterally leading to the edge (comp. numerals 38 and 40 in Figure 2). However, it is also possible that the groove 34 extends up to the edge 54 even though it has several options to discharge the gasses transported by it then.

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Figure 4 shows a side view of a protective helmet according to the invention with a partly cut helmet shell placed on the head of a wearer. In this illustration the edge 54 as well as the grooves 36, 38, 40 ending in the edge are clearly visible.

20 Figure 5 shows a side view of a protective helmet according to the invention with a partly cut helmet shell and interior fittings placed on the head of a wearer. In this illustration in which, in contrast to Figure 4, not only the helmet shell 12 but also the impact absorption device 18 is shown cut along its plane of symmetry a foam pad 56 can be seen via which the support cage 14 rests on the head of the wearer. The foam pad 56 adheres to the bottom of the support cage 14. The support cage 14 holds the impact absorption device 18 in its position between the support cage 14 and the helmet shell 12.

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Figure 6 shows a side view of a protective helmet 10 cut in the longitudinal direction. Figure 7 shows a detail from Figure 6. In both Figures the inner side of the helmet shell 12 cut in the plane of symmetry is regarded. A securing device 16 for securing

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a chin strap is to be seen. It is, symmetric with regard to the sectional plane, also provided on the other side of the helmet shell. During the assembly of the helmet first the impact absorption device 18 is placed in the empty helmet shell 12. During this process the securing devices 26 help positioning the impact absorption device
5 18 relative to the helmet shell 12 and eventually also relative to the subsequently inserted support cage 14. The securing devices 26 are not only useful for securing the chin strap and for supporting the positioning of the impact absorption device 18 but also prevent the impact absorption device 18 from shifting or slipping out of place while the helmet is used. Furthermore, the impact absorption device 18 is also
10 firmly held between the support cage 14 and the helmet shell 12. This is ensured by the support cage 14 having a defined end position when connected to the helmet shell 12 via the securing device 16. In this end position a non-positive connection is established between the support cage 14, the impact absorption device 18, and the helmet shell 12 which guarantees a secure position of the components relative to
15 each other.

The features of the invention disclosed in the above description, in the drawings as well as in the claims may be important for the realisation of the invention both individually and in any combination.

List of Numerals

5	10	protective helmet
	12	helmet shell
	14	support cage
	16	securing device
	18	impact absorption device
10	20	cavities
	22	walls
	24	tubes
	26	securing device
	30	sectional plane
15	32	groove
	34	groove
	36	groove
	38	groove
	40	groove
20	42	opening
	44	opening
	46	opening
	48	detail
	50	cavity
25	52	wall
	54	edge
	56	foam pad

5

Claims

- 10 1. A protective helmet (10) comprising a helmet shell (12), a support cage (14) and a securing device (16) for securing a support cage (14) on the helmet shell (12), **characterised in that** an impact absorption device (18) is disposed between the support cage (14) and the helmet shell (12).
- 15 2. The protective helmet according to claim 1, **characterised in that** that the impact absorption device (18) is, at least partly, positively arranged on the helmet shell (12) and/or the support cage (14).
- 20 3. The protective helmet according to claim 1, **characterised in that** the impact absorption device (18) is, at least partly, non-positively arranged on the helmet shell (12) and/or the support cage (14).
- 25 4. The protective helmet according to one of the preceding claims, **characterised in that** the impact absorption device (18) exhibits a substantially plastic deformation behaviour in case of an impact on the helmet shell (12).
5. The protective helmet according to one of the preceding claims, **characterised in that** the impact absorption device (18) comprises a plurality of cavities (20) which are separated from each other by walls (22).

30

6. The protective helmet according to claim 5, **characterised in that** the cavities are, at least partly, formed as tubes (24).

7. The protective helmet according to claim 6, **characterised in that** the tubes (24) are, at least partly, constituted of one or more extruded copolymers.

8. The protective helmet according to claim 6 or 7, **characterised in that** the tubes (24), at least partly, comprise an inner wall and an outer wall which contact each other, wherein the inner wall is thicker than the outer wall.

10

9. The protective helmet according to claim 6 or 7 or 8, **characterised in that** the tubes (24), at least partly, have an inner wall and an outer wall which contact each other with the outer walls of adjacent tubes being connectable to each other by action of heat.

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10. The protective helmet according to one of the preceding claims, **characterised in that** the impact absorption device (18) is made of Koroyd.

11. The protective helmet according to one of the preceding claims, **characterised in that** the helmet shell (12) comprises an additional securing device (26, 28) by which at least one other component apart from the support cage (14) can be secured on the helmet shell (12), the additional securing device (26, 28) being, in addition, provided as a positioning aid for the impact absorption device (18).

12. The protective helmet according to claim 11, **characterised in that** the additional securing device (26, 28) prevents the impact absorption device (18) from shifting between the helmet shell (12) and the support cage (14).

13. The protective helmet according to one of the preceding claims, **characterised in that** the securing device (16) for securing the support cage (14) on the helmet shell (12) is designed so that the support cage (14) assumes an end position

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with respect to the securing device (16) in the used state of the protective helmet (10), and that the support cage (14) applies a force to the impact absorption device (18) in the end position which prevents a shift of the impact absorption device (18) between the helmet shell (12) and the support cage (14).

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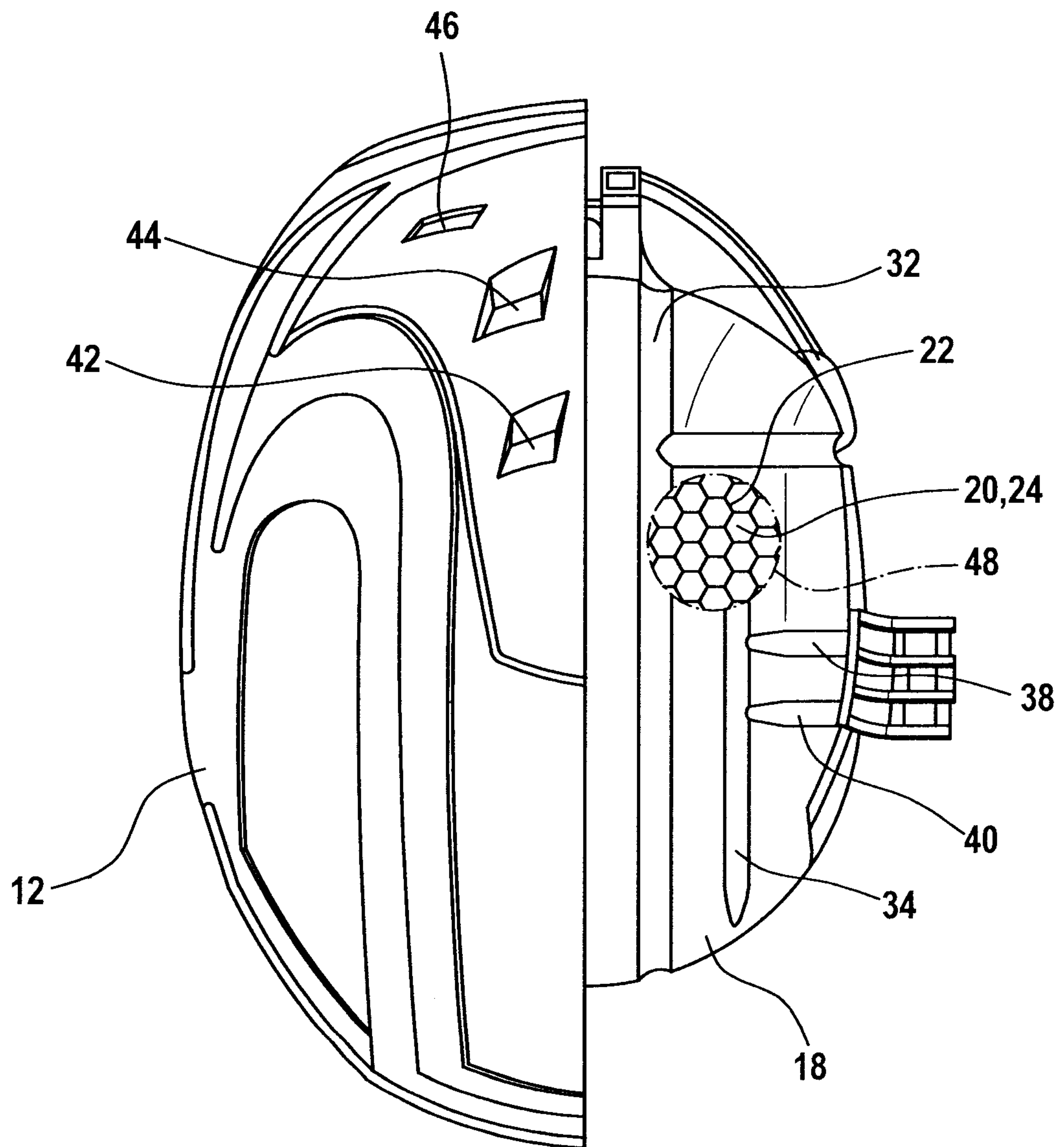
14. The protective helmet according to one of the preceding claims, **characterised in that** the impact absorption device (18) has grooves (32, 34, 36, 38, 40) forming ventilation channels together with the helmet shell (12) on its side facing the helmet shell (12).

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15. The protective helmet (10) according to claim 1, **characterised in that** the ventilation channels communicate with openings (42, 44, 46) of the helmet shell (12).

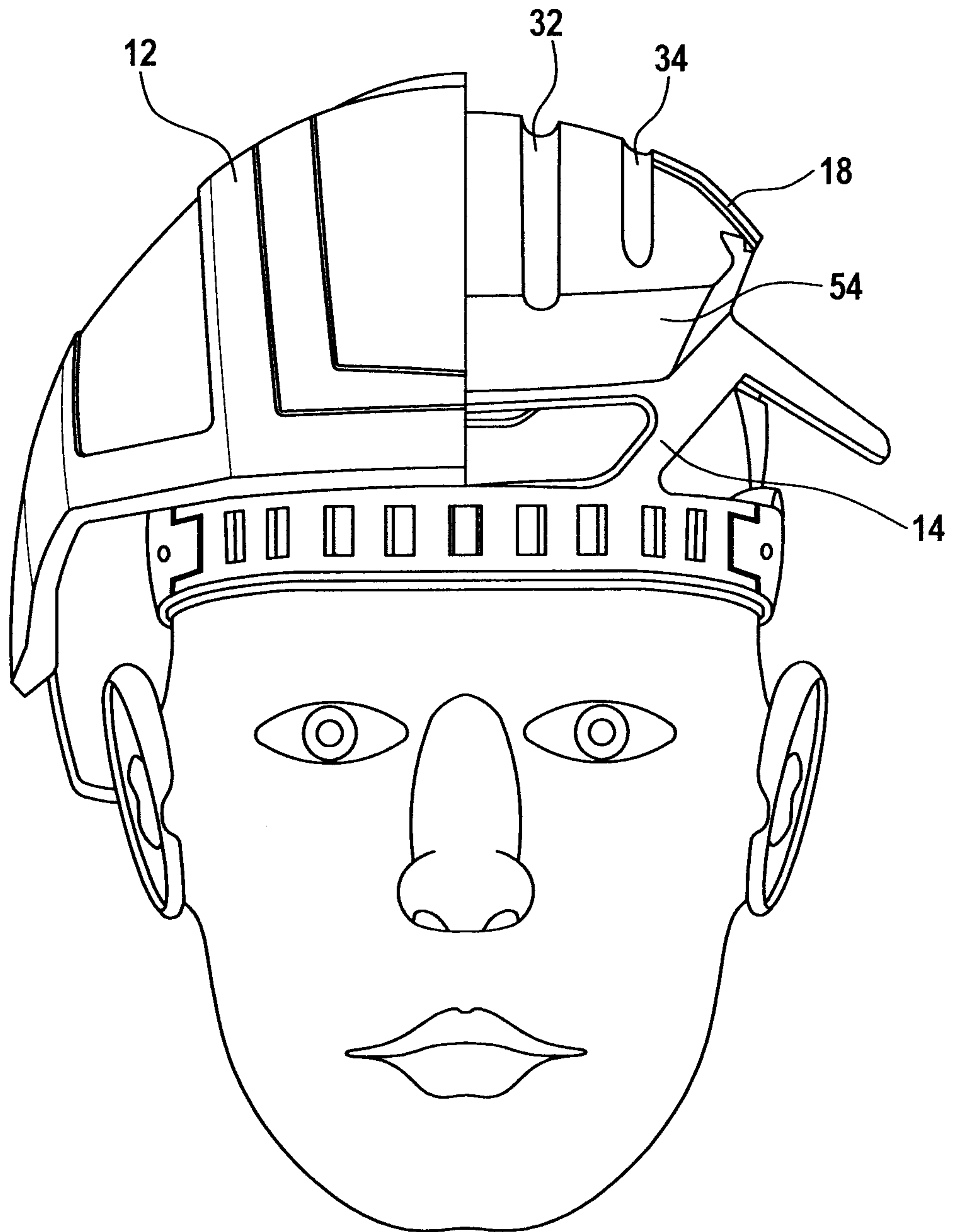
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Fig. 2



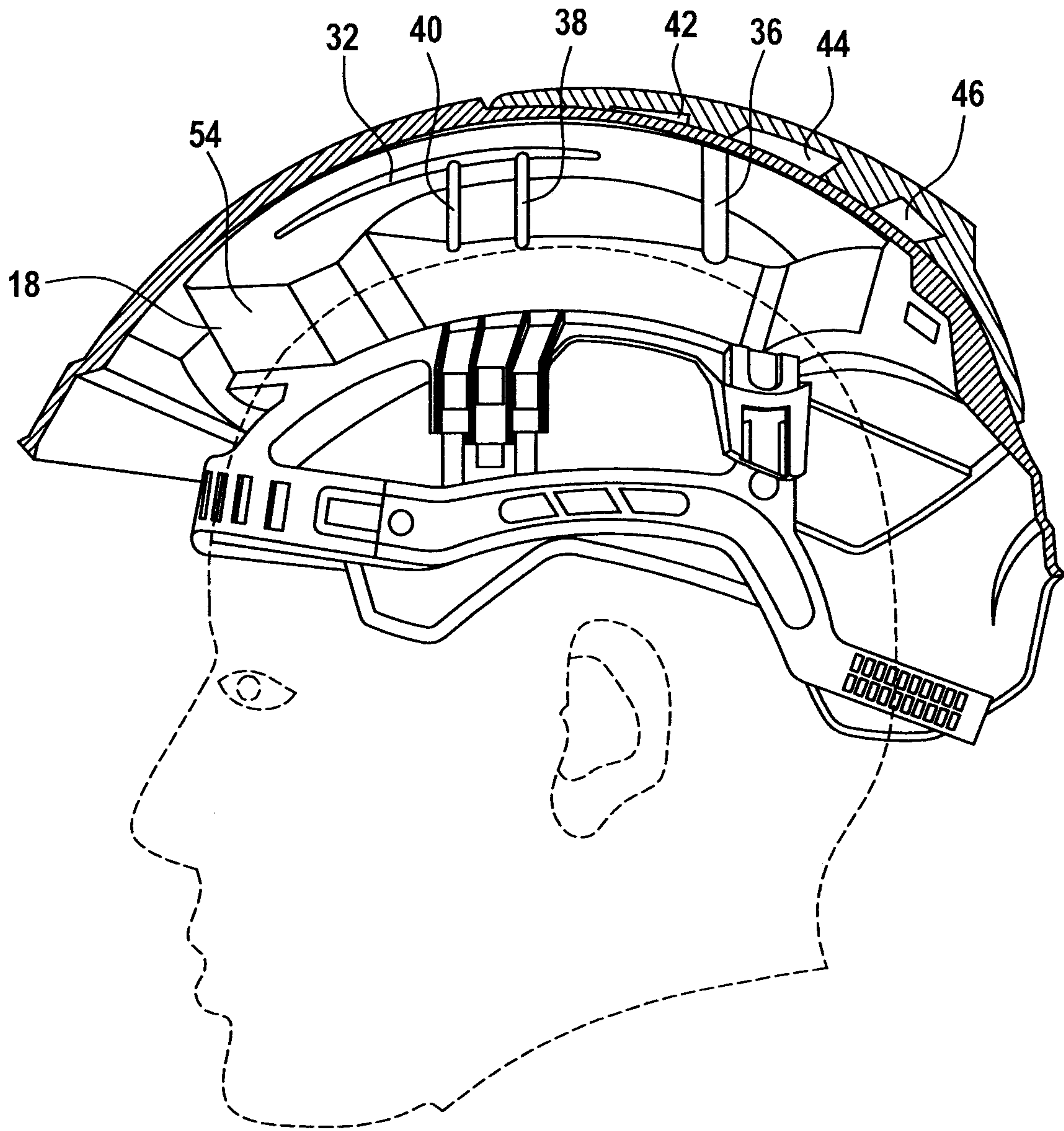
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Fig. 3



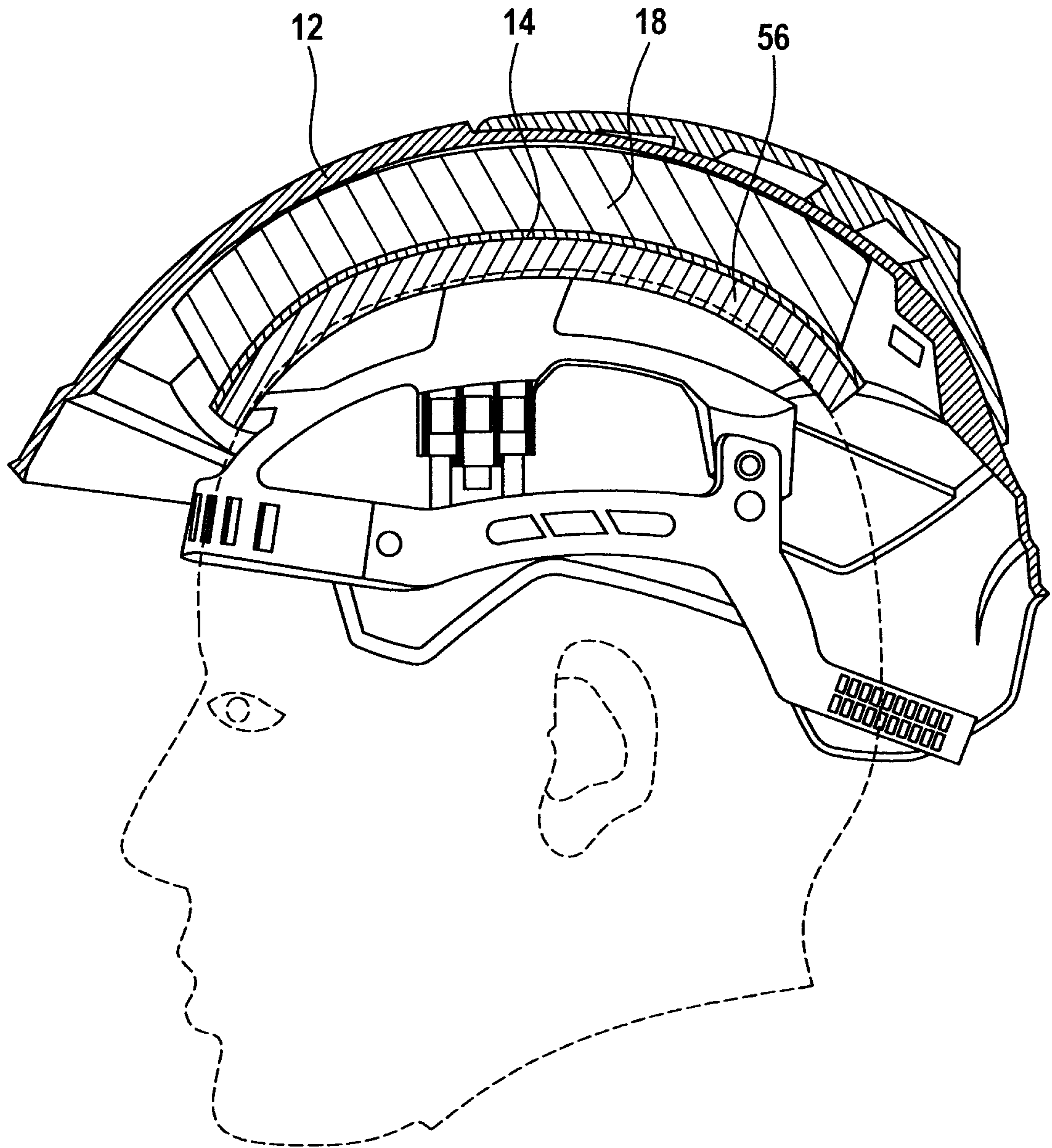
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Fig. 4



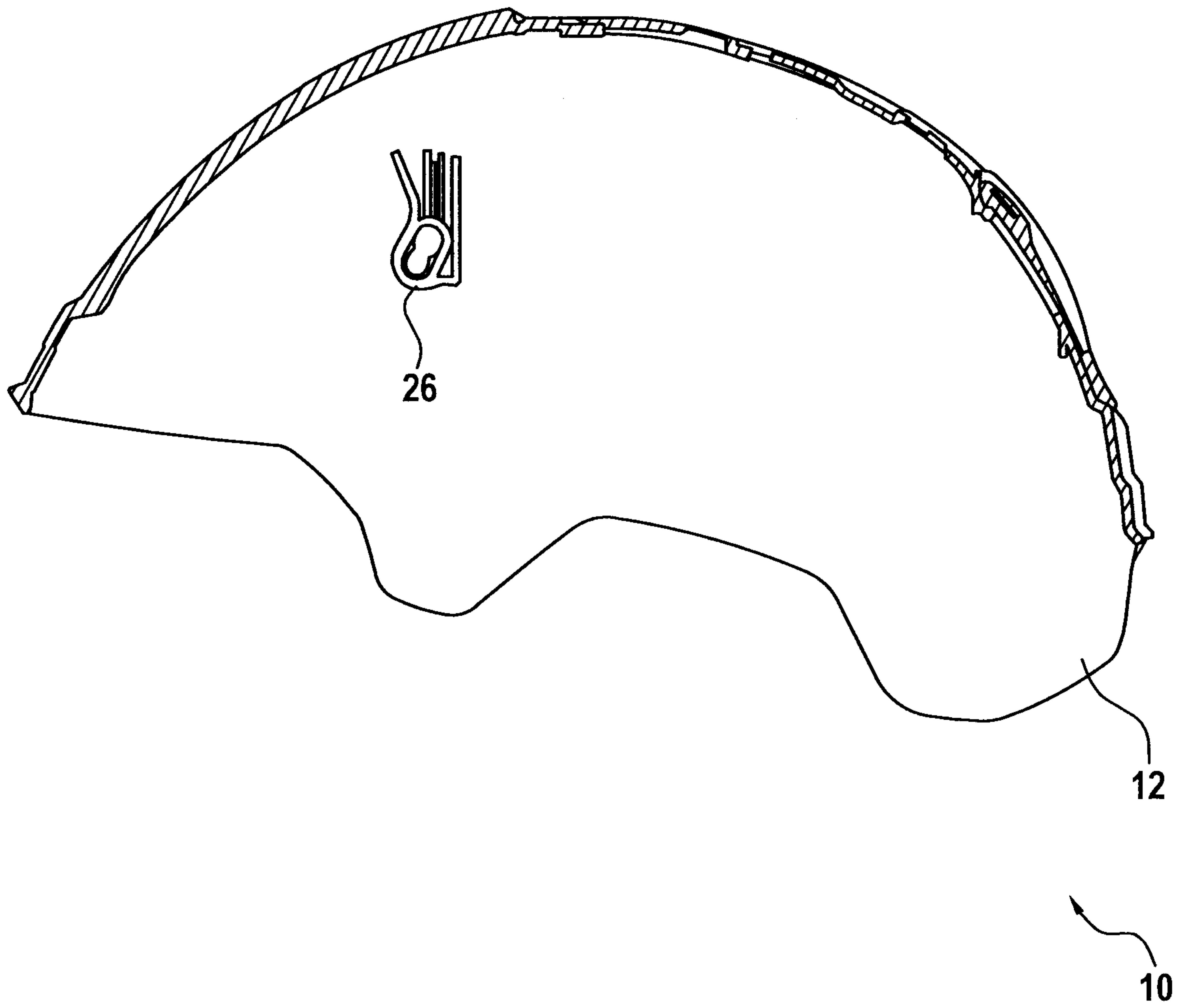
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Fig. 5



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Fig. 6



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Fig. 7

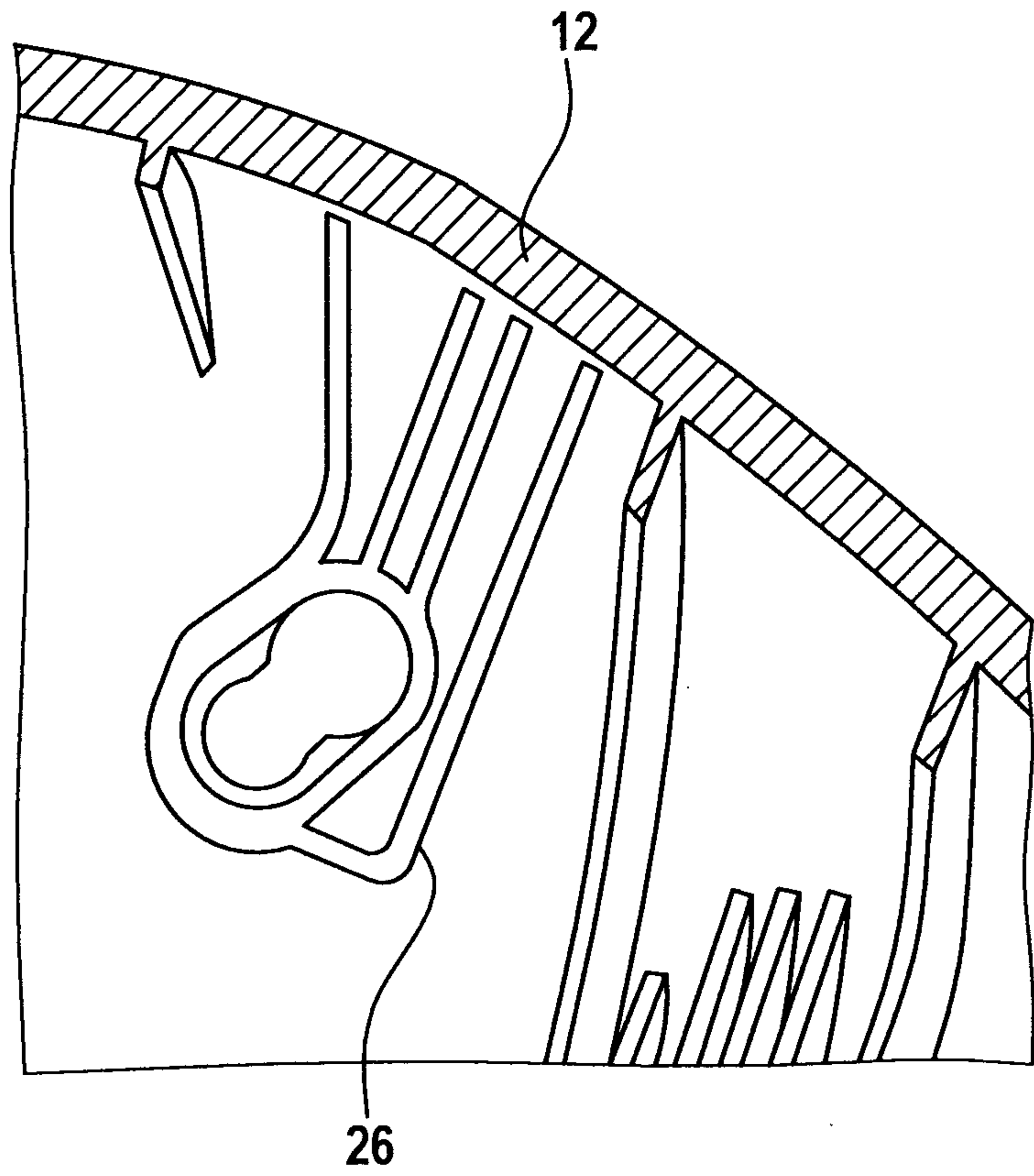


Fig. 1

